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# Ecological momentary assessment and beyond: The rising interest in e-mental health research

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*To the Editor,*

We read with interest the recent article by Moore et al. (2016), which used smartphones as a means of capturing ecological momentary assessment (EMA) data in a trial of mindfulness. As the authors point out, the smartphone-based EMA measures outperformed the traditional methods (i.e. paper-and-pencil), even among older adults. This interesting paper is a clear example of the potential benefits of 'eHealth' (or 'mHealth'), which refers to the use of computerized (or mobile phone) technologies applied within the healthcare setting. In response to the potential for improving healthcare, these novel methods are increasingly adopted, and studied, in medical research.

This includes psychiatric research, where interest in 'e-mental health' is increasing. Along with providing real-time tracking of mental health status (as observed in Moore et al., 2016), mental health 'apps' have been developed to deliver adjunctive psychosocial interventions via smartphones (Hollis et al., 2015). In addition, recent technological advances (and the spread of internet-connectivity) has presented further opportunities for other types of e-mental health interventions, such as computerized self-help and videoconferencing therapy (Christensen and Petrie, 2013; Aboujaoude et al., 2015).

E-mental health interventions confer significant benefits for services, being easily scalable, of minimal expense, and available to many outpatients who may struggle to access regular care (Torous and Baker, 2016). However, the extent to which the evaluation of these technologies has kept up with their use is unclear. Indeed, recent attempts by healthcare services to introduce e-mental health have received criticism on this basis (Huckvale et al., 2015; Leigh and Flatt, 2015).

We examined the trajectory of growth in e-mental health research by assessing the number of related articles published per year since the inception of the field. This was done by searching the largest medical research database, PubMed, for all 'e-mental health' articles; defined as any article labelled with MeSH Major Topics terms for both 'eHealth' and 'Mental Disorders'. This combination of phrases was used because the MeSH term 'eHealth' also returns all articles linked with 'mHealth' and 'telemedicine', just as 'Mental Disorders' also captures 'mental illness' or 'mental illnesses'. The search returned 669 results between 1993 and 01/01/2014 (as more recent articles have yet to be MeSH indexed). After categorising articles by year of publication (Blanner Kristiansen and Høstrup Vestergaard, 2015), linear regression shows that the number of e-mental health articles has been significantly increasing since 1993 ($F = 69.31$, $df = 19$, $p < 0.001$). However, this fails to account for general increases in psychiatric and/or eHealth research over the last two decades.

Therefore, we examined what percentage of research has been published per-year for each of three possible searches: (i) 'mental disorders', (ii) 'eHealth', (iii) 'e-mental health'. As shown in Fig. 1, there have only been moderate changes in 'mental disorders' and 'eHealth' articles over the 20-year time frame. Conversely, there was a sharp increase in e-mental health research, with 57% of the literature been published in the last 5 years. Yearly publications in

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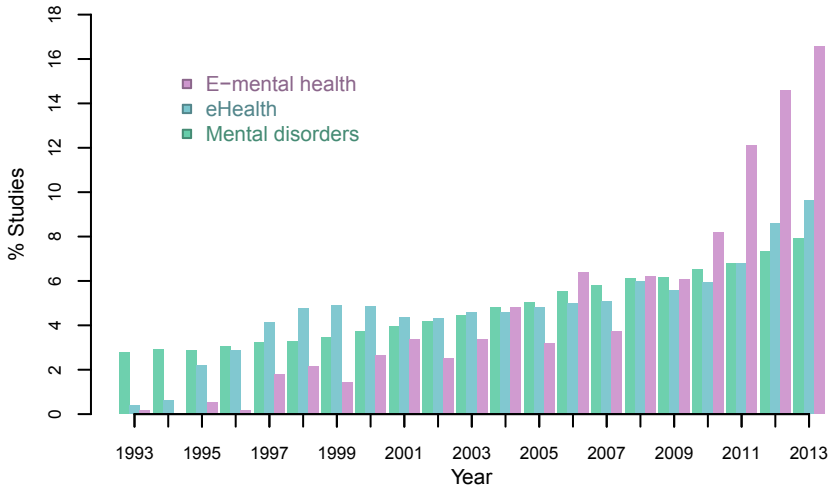


**Fig. 1. Proportions of research published overtime**. Figure shows the yearly percentage of all published articles for: (i) e-mental health; (ii) eHealth, and (iii) mental disorders.

e-mental health almost trebled between 2009 and 2014.

We also quantified the relative growth of 'e-mental health' within psychiatric research more broadly: For each year, we calculated the proportion of 'mental disorders' publications that were 'e-mental health'. Using this as the dependent variable, and year as the independent predictor, we carried out generalized linear regression models with quasi-binominal error structure (to allow for overdispersion). This showed that the proportion of mental disorders research pertaining to 'e-mental health' has been increasing overtime (coeff = 0.111, s.e = 0.013, $p < 0.001$).

In summary, there has been substantial growth in e-mental health research over the last five years; greater than the growth rate in either of its parent fields. This increased interest in e-mental health may reflect the new possibilities for researchers, clinicians and patients afforded by technological developments and increasingly ubiquitous internet access (Hollis et al., 2015; Torous and Baker, 2016). The dissemination of such interventions is also becoming more feasible, as psychiatric patients become increasingly likely to own and use mobile phones and laptop computers (Firth et al., 2015; Lal et al., 2015).

Among the various types of e-mental health interventions, the efficacy of smartphone apps for mental healthcare is relatively under-researched, with a lack of randomised trials (Christensen and Petrie, 2013; Aboujaoude et al., 2015). For instance, in the United Kingdom, the National Health Service recently launched an online 'Health Apps Library' to recommend an array of mental health apps. However, this library has now been closed following concerns over data privacy and the insufficient evidence for recommended apps (Huckvale et al., 2015; Leigh and Flatt, 2015). Nevertheless, the evidenced academic interest in this area could soon fill the gaps, as further studies like Moore et al. (2016) continue to demonstrate the benefits of mHealth technologies.

## Conflict of interests

All authors declare no conflict of interest.

## Contributors

All authors were involved in the conception, drafting and final approval of this manuscript.

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